



# ***Chickahominy River and Tributaries Final TMDL & First Implementation Planning Meeting***

**May 24, 2012**

Bacteria TMDL and Implementation Plan for the  
Chickahominy River and Tributaries



**NATURAL RESOURCE SOLUTIONS**  
THROUGH *Science AND Engineering*

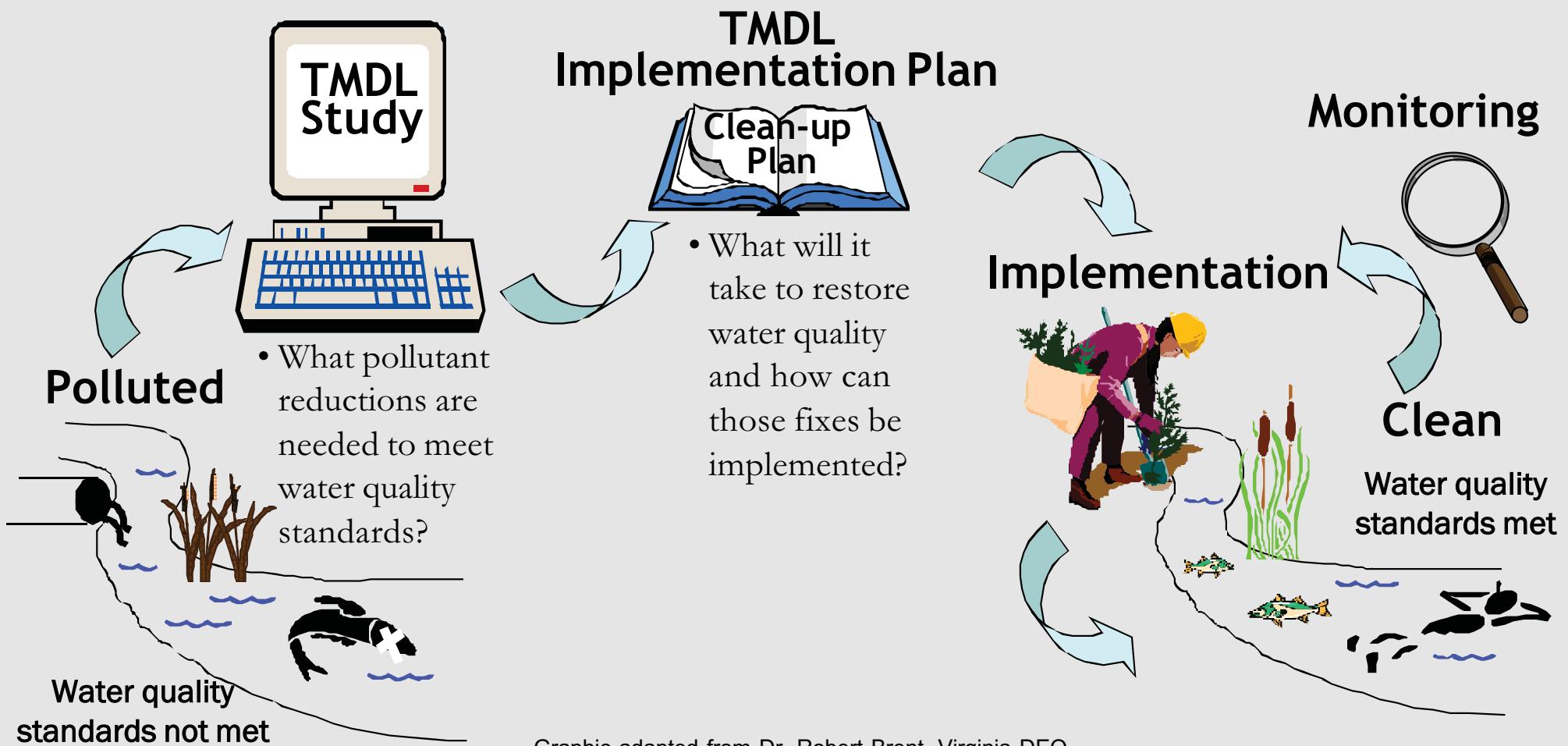
# Why Are We Here?

To discuss bacteria TMDLs for Chickahominy River and Tributaries watershed

Total Maximum Daily Load is how much pollutant can enter the stream and have the stream meet the water quality standards



# Overview of TMDL Process



# The Pollutants We Are Dealing With Here

- Excessive Bacteria

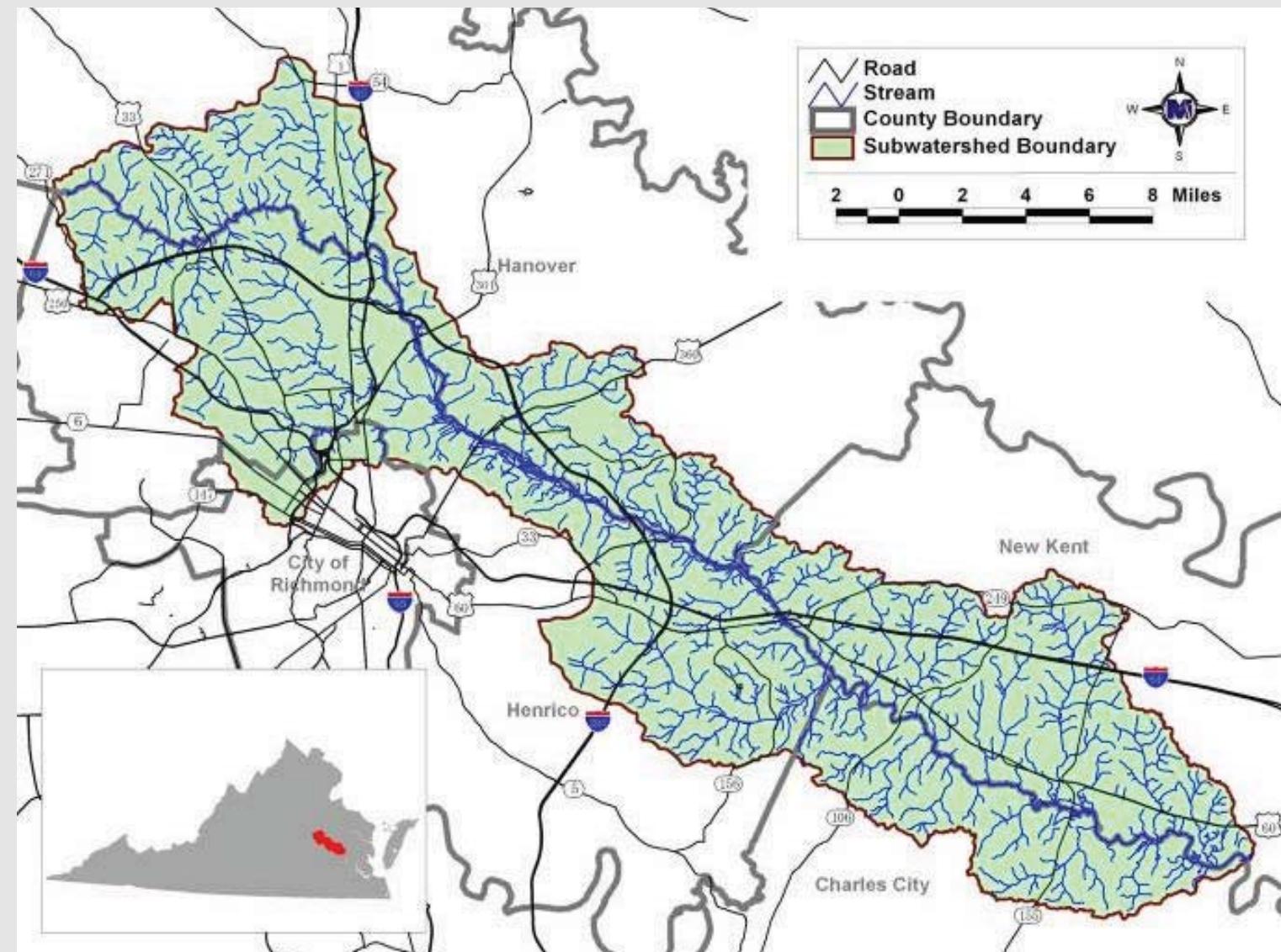


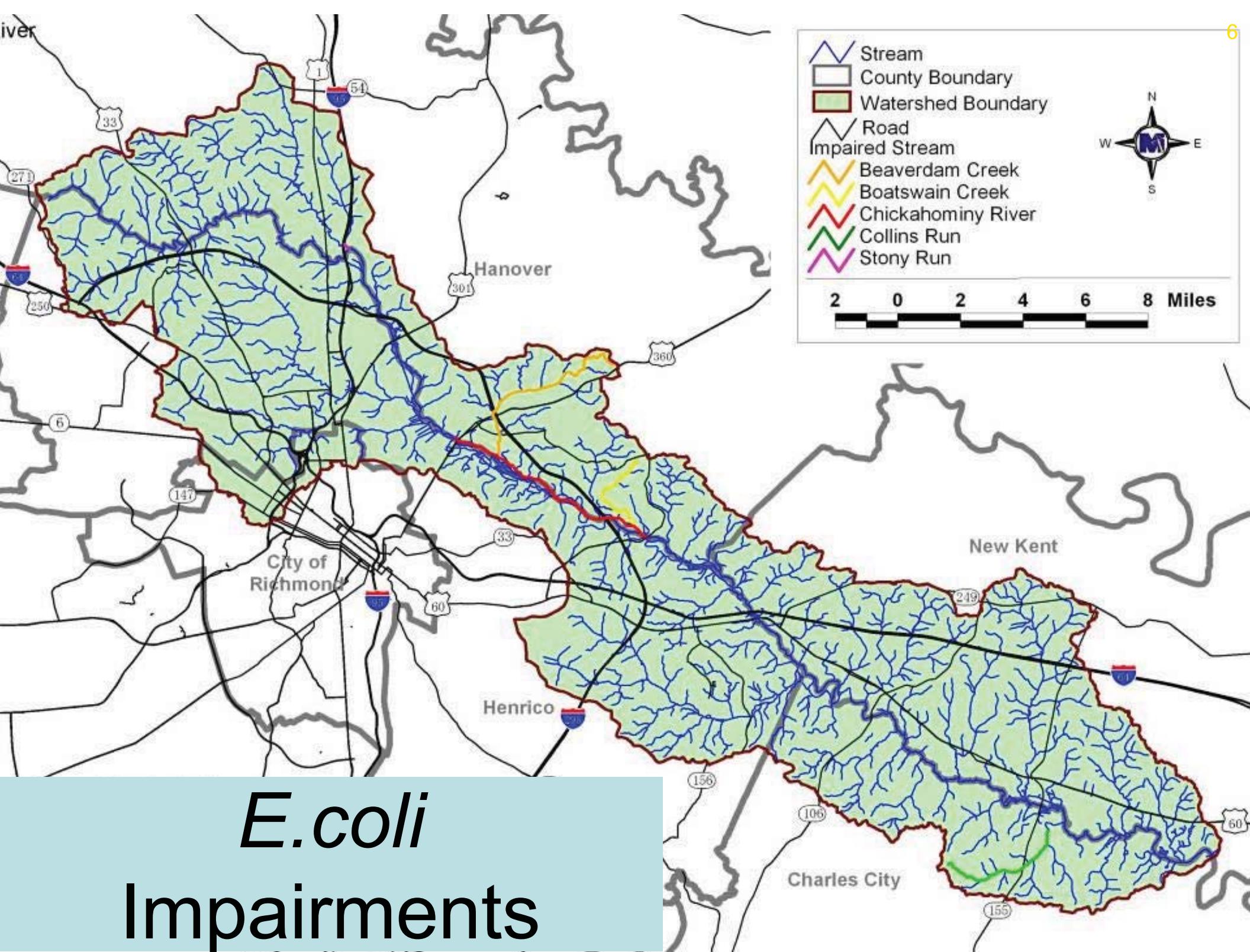
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# Drainage Area

- Parts of Henrico, Hanover, New Kent, and Charles City counties and a small part of the City of Richmond
- Approximately 194,000 acres
- Forest ~ 50%
- Developed ~ 16%
- Pasture/Hay ~ 12%
- Cropland ~ 6%
- Wetlands ~ 10%
- Commercial ~ 5%





# *E.coli* Impairments

Stream Name Impairment ID	Initial Listing Year	2010 River Miles	EC 2010 Listing Violation %	Impairment Location Description
Collins Run VAP-G07_CNR01A00	2002	4.50	33 EC	From the headwaters to river mile 0.99.
Beaverdam Creek VAP-G06R_BEV01A00	2006	6.69	27 EC	From the headwaters to its confluence with the Chickahominy River.
Boatswain Creek VAP-G06R_BTS01A02	2006	3.76	31 EC	From the headwaters to its confluence with the Chickahominy River.
Chickahominy River VAP-G06R_CHK01A98	2008	7.54	12 EC	From the Route 360 bridge downstream the Route 156 bridge.
Stony Run VAP-G05R_SNF01A02	2004	0.21	27 EC	From its confluence with Lickinghole Creek to its mouth at the confluence with the Chickahominy River.

# TMDL Approach

- Identify and quantify contributors to the problem;
- Incorporate the drainage area's characteristics and pollutant parameters to establish the baseline for existing conditions;
- Determine the necessary reductions for achievement of the standard or endpoint.

# Where Bacteria In Streams Comes From

- Permitted discharges
  - Wastewater treatment facilities
  - Other Permitted Discharges
- Human
  - Biosolids
  - Failed Septic Systems
  - Straight Pipes
  - Overflows
- Pets
- Livestock
- Wildlife



# How do we Determine the TMDLs?



Watershed data



TMDL

# Needed Reductions in Bacteria Loadings to Water

Source	Needed Reduction (%)
Sanitary Sewer Overflows	100
Straight Pipes	100
Direct Livestock Deposition to Stream	100
Direct Wildlife Deposition to Stream	77
Load from Forest, Barren, Commercial, and Wetlands	77
Load from Agricultural and Developed Lands	99

# Bacteria TMDL

Impairment	WLA <sup>1</sup> (cfu/yr)	LA (cfu/yr)	MOS	TMDL (cfu/yr)
Chickahominy River at Subwatershed 1 outlet VA0004031	3.83E+12	4.23E+12		8.06E+12
J. Sargeant Reynolds Community College MS4(VAR040107)	3.60E+12			
MS4 Henrico County (VA0088617) MS4 VDOT in Henrico County		3.50E+08		
MS4 Hanover County (VAR040012) MS4 Town of Ashland (VAR040011) MS4 VDOT in Hanover County	}	1.04E+11	Implicit	
MS4 Richmond City (VAR040005) MS4 VDOT in Richmond City				
VPG100026 Future Load	0	8.06E+10		

<sup>1</sup>The WLA reflects an allocation for potential future permits issued for bacteria control. Any issued permit will include bacteria effluent limits in accordance with applicable permit guidance and will ensure that the discharge meets the applicable numeric water quality criteria for bacteria at the end-of-pipe.

<sup>2</sup>Each of the municipality MS4 loads has been aggregated with a portion of the adjacent VDOT MS4 load, due to the continuity of the system. For MS4/VSMP permits, the permittee may address the TMDL WLAs for stormwater through the iterative implementation of programmatic BMPs.



- Public Review (ends Mon June 25, 2012)
- Submit to EPA
- State Approval
- Implementation



# TMDL Implementation Plan

Document that details actions or strategies that will be undertaken to achieve load reductions as defined by the TMDL study.



# Components of an Implementation Plan

- Public Participation
- Review of TMDL
- Corrective Actions
  - BMPs, educational programs, regulatory authority, incentives
- Cost/Benefit Analysis
- Measurable Goals
- Timeline to Achieve Water Quality Objectives
  - Includes monitoring plan to assess progress



# Cost/Benefit Analysis

- Assess cost for implementation
- Evaluate environmental benefit through modeling
- Compare Cost-Effectiveness
- Identify/Evaluate economic benefits of Implementation
- Identify funding sources



# Local Issues

- Coordination with other plans
  - Bay TMDL

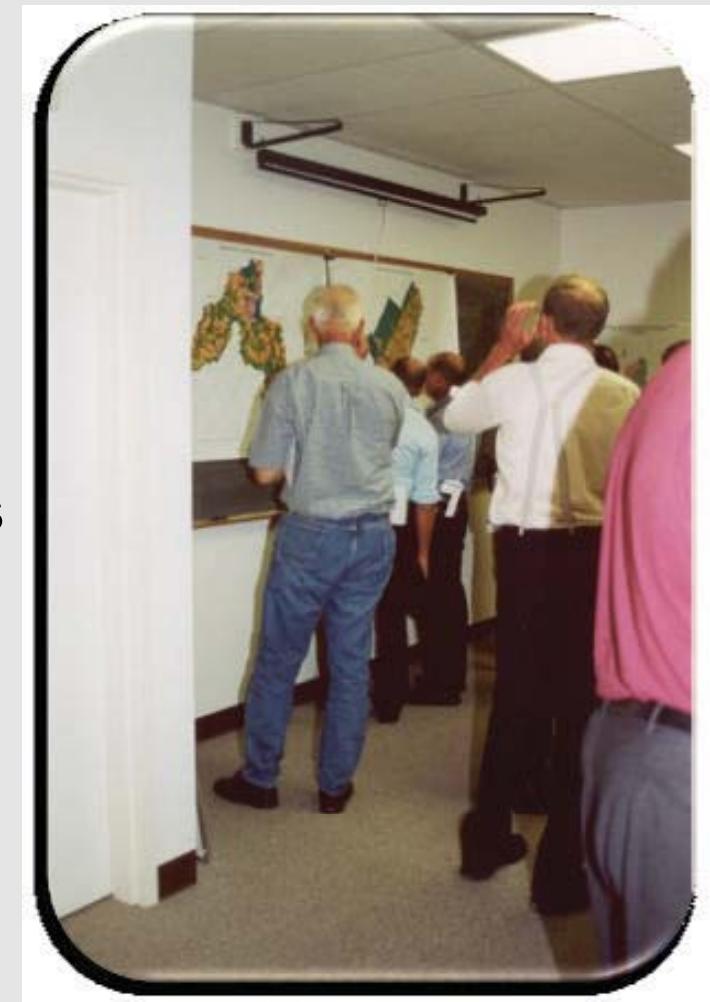


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# Public Participation

- Public Meetings
  - Informational
  - Solicit public participation
  - Provide a forum for public comment
- Working Groups
  - Address “community” issues/concerns
- Steering Committee
  - Direct the overall process
  - Review output from working groups
  - Review future implementation



# Agricultural Working Group

## Responsibilities:

- Identify potential constraints to implementation
- Identify alternative funding sources/partnerships
- Review implementation strategies from an agricultural perspective
- Identify outreach methods for engaging agricultural producers



# Residential Working Group

## Responsibilities:

- Identify possible constraints to implementation
- Identify methods of outreach to homeowners with sewage problems
- Identify alternative funding sources/partnerships
- Review implementation strategies from a homeowner's perspective



# Government/ Urban Working Group

## Responsibilities:

- Identify funding sources
- Identify available technical resources
- Identify appropriate “measurable goals” and timeline for achievement
- Identify regulatory controls currently in place
- Identify potential parties to be responsible for agricultural, residential, and urban implementation
- Evaluate various corrective actions, costs, tracking procedures, and technical assistance needs



# Steering Committee

## Responsibilities:

- Direct overall process
- Review output from working groups
- Identify methods of public outreach
- Review future implementation



# Implementation Needs



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# Agricultural Management Measures

Agricultural Control Measure Description	Unit	Units Needed	Suggested Unit Cost
Conservation Tillage - Cropland	ac		\$100
Retention Ponds- Cropland	ac		\$200
Vegetated Buffer- Cropland	ft		\$5
Composting for 1/3 of Dairy Replacement	Systems		"
Waste Storage for 1/3 of Dairy Replacement	Systems		"
Composting - for 200 horses	Systems	"	"
Waste Storage- for 1,000 horses	Systems	"	"
Improved Pasture Management	ac		\$75
Retention Ponds- pasture	ac		\$200

# Residential Management Measures

Residential Control Measure Description	Unit	Units Needed	Suggested Unit Cost
<b><i>Straight Pipe Corrections:</i></b>			
Sewer Connection	system		\$6,000
Alternative Waste Treatment System Installation	system		\$20,000
Septic System Installation/Replacement	system		\$8,000
<b><i>Failing Septic Systems Corrections:</i></b>			
Septic Installation	system		\$8,000
Septic Repair	system		\$3,000
Sewer Connection	system		\$6,000
<b>Bioretention</b>			
	ac		\$10,000
<b>Rain Garden</b>			
	ac		\$5,000
<b>Vegetated Buffer</b>			
	ft		\$5
<b>Retention Ponds</b>			
	ac		\$200
<b>Pet Waste Composter</b>			
			\$50
<b>Pet Litter Control Program</b>			
	program		\$15,000
<b>Overflow correction</b>			
	program		"

- **Right Now** – Break into respective workgroups for briefing and homework assignment
  
- Public Comment for 1<sup>st</sup> IP meeting ends Monday June 25, 2012
- 1<sup>st</sup> Working Group Meetings - mid/late June
- 2<sup>nd</sup> Working Group Meetings - mid/late July
- 1<sup>st</sup> Steering Committee Meetings - mid/late Aug
- 2<sup>nd</sup> Steering Committee Meetings - mid/late Sept
- Draft IP/Final Public Meeting/Comment period – October
- Final Document by end 2012/first of 2013
- State Water Control Board Approval



We appreciate that you're taking the time to come to the meeting!

We appreciate your feedback!



Bacteria TMDL and Implementation Plan for the  
Chickahominy River and Tributaries

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# Contact Information

**VDEQ**  
**Margaret Smigo**  
**Regional TMDL Coordinator**  
**DEQ- W. Piedmont Regional Office**  
**4949-A Cox Road**  
**Glen Allen, VA 23060**  
**Office(804) 527-5124**  
**Fax (804)527-5106**  
**[Margaret.Smigo@deq.virginia.gov](mailto:Margaret.Smigo@deq.virginia.gov)**

**MapTech, Inc.**  
**Mohammad Alsmadi, PhD**  
**Environmental Scientist**  
**[malsmadi@maptech-inc.com](mailto:malsmadi@maptech-inc.com)**  
**(540) 961-7864**

*Send Margaret Written Comments (mail,  
email, or fax) by:*

*Monday June 25, 2012*



3154 State Street  
Blacksburg, VA 24060  
[www.maptech-inc.com](http://www.maptech-inc.com)

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# Appendix A

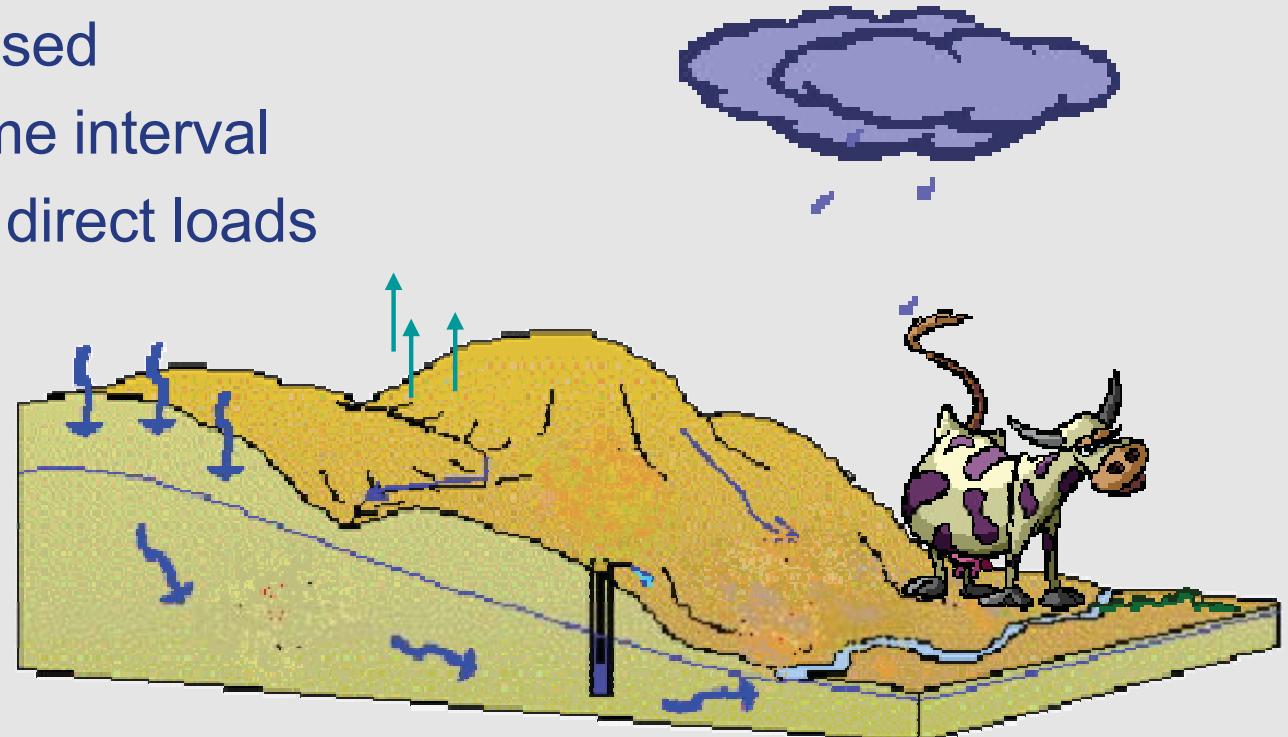
## Modeling

# Modeling - Bacteria

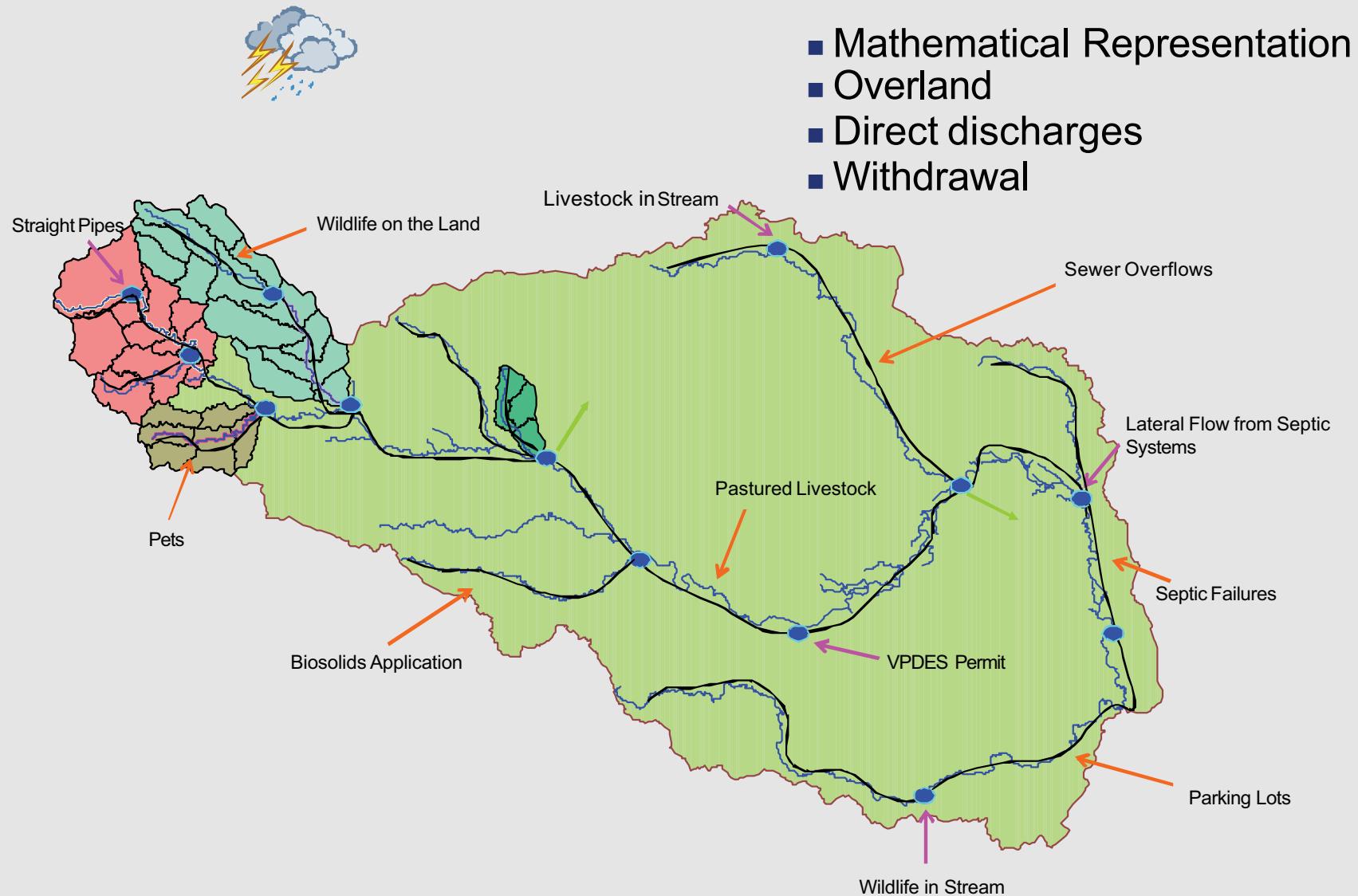
## ■ Rainfall-Runoff-Water Quality

### ■ Hydrologic Simulation Program – Fortran (HSPF)

- Watershed-based
- Continuous time interval
- Land-applied, direct loads

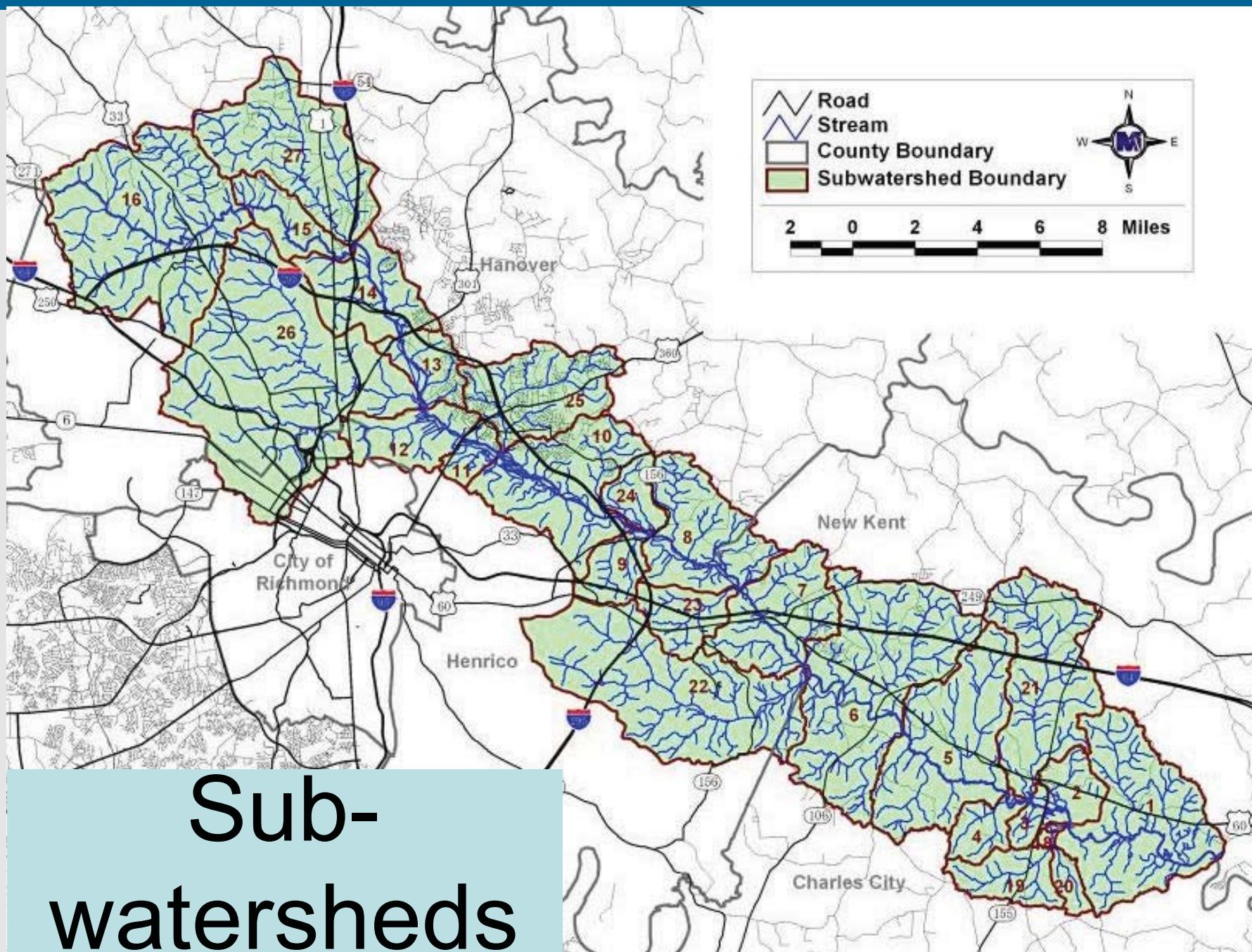


# Conceptual Model



# Appendix B

## Source Assessment



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Sub-watershed	Human Population	Housing Units	Homes with Sewer	Homes with Septic	Estimated Homes with Straight Pipes
1	696	333	6	326	1
2	181	73	1	72	0
3	108	45	0	45	0
4	254	100	0	100	0
5	1,192	471	0	469	2
6	4,522	1,823	27	1,794	2
7	2,770	1,133	21	1,111	1
8	1,502	618	225	393	0
9	3,356	1,523	1,428	95	0
10	13,995	5,502	4,592	909	1
11	5,820	2,211	2,169	42	0
12	12,658	5,656	5,592	63	1
13	4,839	1,833	1,689	144	0
14	12,135	5,306	5,051	254	1
15	1,525	670	255	413	2
16	34,755	13,285	12,095	1,187	3
17	2	1	0	1	0
18	14	6	0	6	0
19	315	152	0	152	0
20	75	28	0	28	0
21	596	267	0	267	0
22	6,126	2,507	2,330	171	6
23	876	434	416	17	1
24	307	136	0	136	0
25	20,769	8,100	6,930	1,167	3
26	101,467	47,745	46,398	1,341	6
27	5,296	2,187	1,295	887	5
Total	236,151	102,145	90,520	11,590	35

# Human

# Livestock

Sub-watershed	Beef	Beef Calves	Dairy Replacements	Horse	Sheep	Hog
1	15	22	0	63	0	0
2	6	8	0	26	0	0
3	0	1	0	0	0	0
4	1	2	0	0	0	0
5	12	19	0	36	0	0
6	33	47	0	124	0	0
7	24	25	0	110	5	0
8	43	32	0	101	7	0
9	6	5	0	30	0	0
10	71	52	0	164	6	0
11	3	3	0	8	0	0
12	17	15	0	35	1	0
13	6	4	0	22	2	0
14	30	23	0	63	5	0
15	23	18	0	54	4	0
16	76	56	0	236	9	0
17	0	0	0	0	0	4,440
18	1	1	0	0	0	0
19	2	3	0	0	0	0
20	1	1	0	0	0	0
21	19	25	0	82	0	0
22	49	39	0	231	19	0
23	10	8	0	48	0	0
24	4	3	0	24	2	0
25	19	14	0	116	9	0
26	29	28	0	141	0	0
27	24	18	30	147	11	0
Total	524	472	30	1,861	80	4,440

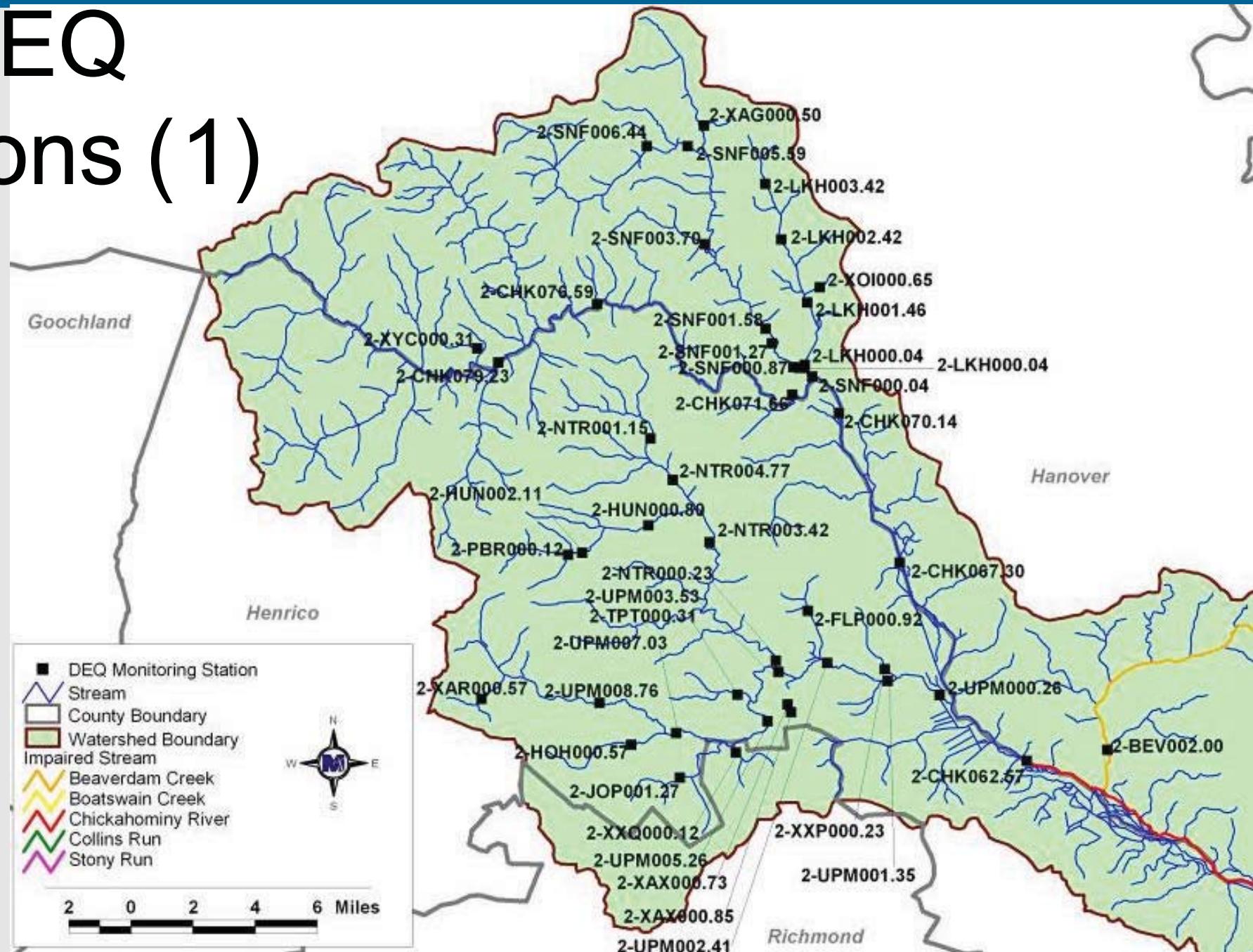
Sub-watershed	Deer	Turkey	Beaver	Raccoon	Muskrat	Duck	Goose
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
Total							

# Wildlife

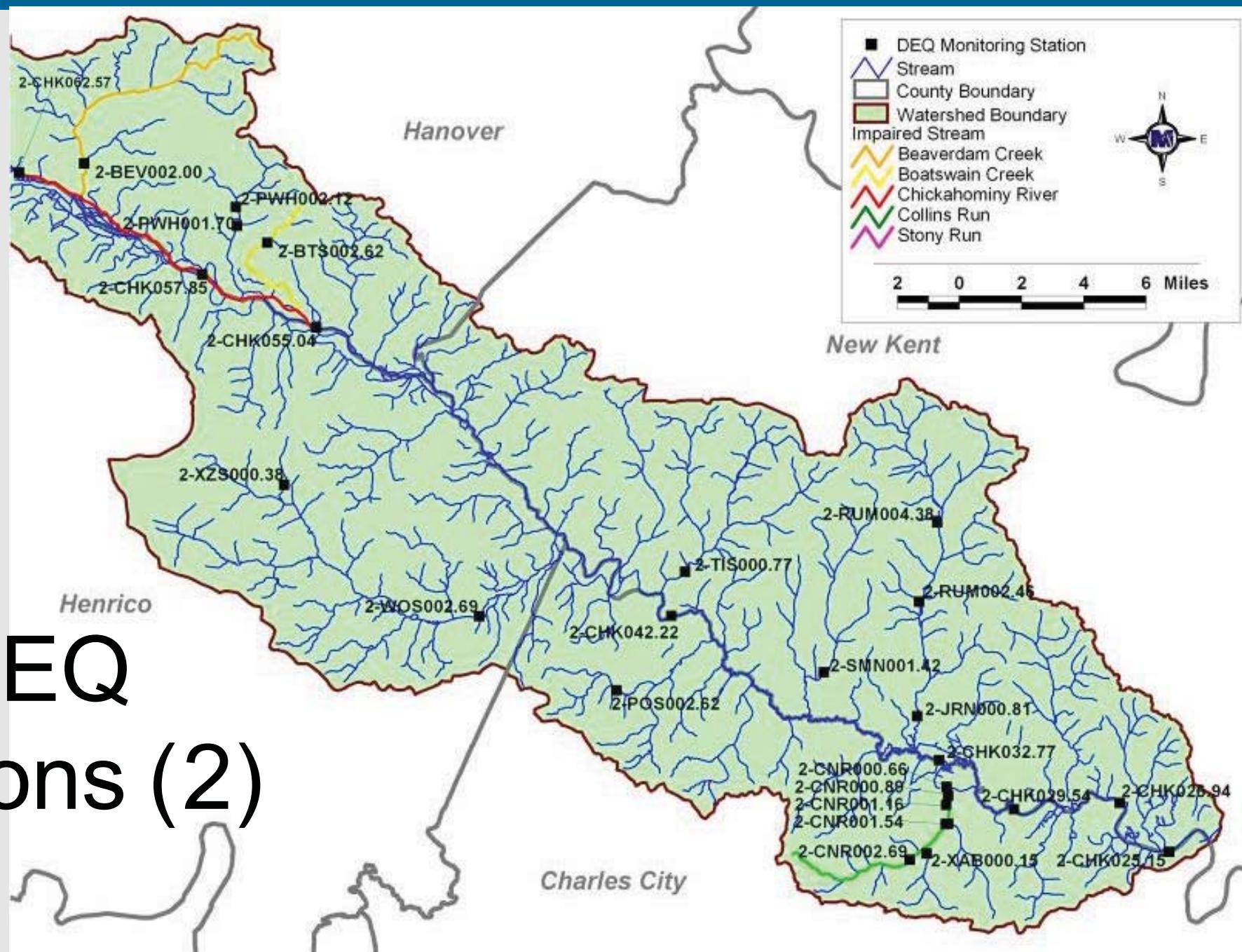
# Appendix C

## Monitoring

# DEQ Stations (1)



# DEQ Stations (2)



# DEQ Monitoring (Fecal Coliform)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Chickahominy River	2-CHK025.15	4/2001 - 10/2001	7	100	100	100	100	0	0.0
Chickahominy River	2-CHK026.94	4/2001 - 10/2001	7	100	100	100	100	0	0.0
Chickahominy River	2-CHK029.54	4/2001 - 10/2001	7	100	200	114	100	38	0.0
Chickahominy River	2-CHK032.77	1/2001 - 3/2006	32	25	1,100	107	100	186	3.1
Chickahominy River	2-CHK042.22	5/2001 - 6/2003	13	100	400	162	100	112	0.0
Chickahominy River	2-CHK055.04	1/2001 - 5/2003	27	100	2,200	207	100	403	3.7
Chickahominy River	2-CHK057.85	5/2004	1	2,000	2,000	2,000	NA	NA	100.0
Chickahominy River	2-CHK062.57	1/2001 - 1/2011	47	25	1,200	195	100	281	19.1
Chickahominy River	2-CHK067.30	6/2001 - 5/2003	13	100	500	154	100	120	7.7
Chickahominy River	2-CHK070.14	3/2007	1	25	25	25	NA	NA	0.0
Chickahominy River	2-CHK076.59	1/2001 – 1/2011	34	25	2,000	315	100	562	14.7
Chickahominy River	2-CHK079.23	6/2001 - 5/2003	13	100	1,200	323	100	352	15.4

NA – Not applicable

<sup>1</sup>Based on the instantaneous fecal coliform standard of 400 cfu/100mL.

# DEQ Monitoring (Fecal Coliform)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Chickahominy River X-Trib	2-XYC000.31	4/2006	1	25	25	25	NA	NA	0.0
Collins Run	2-CNR000.89	3/2001 - 4/2002	6	18	1,300	301	120	500	16.7
Collins Run	2-CNR001.16	3/2001 - 4/2002	6	45	2,200	479	114	850	16.7
Collins Run	2-CNR001.54	3/2001 - 4/2002	6	18	2,400	425	19	968	16.7
Jones Run	2-JRN000.81	1/2001 - 3/2001	2	100	100	100	NA	100	0.0
North Run	2-NTR005.53	2/2002 - 3/2004	3	50	200	117	100	76	0.0
Possum Run	2-POS002.62	3/2006	1	25	25	25	NA	NA	0.0
Powhite Creek	2-PWH001.70	3/2005	1	25	25	25	NA	NA	0.0
Stony Run	2-SNF000.04	6/2001 - 5/2003	12	100	1,000	258	100	326	16.7
Toe Ink Swamp	2-TIS000.77	8/2003	1	75	75	75	NA	NA	0.0
Upham Brook	2-UPM003.53	10/2001 - 3/2001	3	330	3,500	1,643	1,100	1,653	66.7
White Oak Swamp X-Tributary	2-WOS002.69	1/2000 - 7/2003	34	20	2,700	433	100	692	20.6
White Oak Swamp X-Tributary	2-XZS000.38	5/2008	1	25	25	25	NA	NA	0.0

NA – Not applicable

<sup>1</sup>Based on the instantaneous fecal coliform standard of 400 cfu/100mL.

# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Beaverdam Creek	2-BEV002.00	8/2003 - 11/2010	23	25	1,300	231	100	352	26.1
Boatswain Creek	2-BTS002.62	5/2004 - 11/2006	16	25	650	215	88	236	31.3
Chickahominy River	2-CHK025.15	4/2006 – 10/2011	14	25	25	25	25	25	0.0
Chickahominy River	2-CHK026.94	4/2006 - 10/2011	14	25	50	27	25	8	0.0
Chickahominy River	2-CHK029.54	4/2006 - 10/2011	14	25	175	50	25	45	0.0
Chickahominy River	2-CHK032.77	7/2003 - 3/2006	21	25	880	86	25	186	4.8
Chickahominy River	2-CHK038.52	6/2011	1	40	40	40	NA	NA	0.0
Chickahominy River	2-CHK042.22	1/2007 - 11/2008	12	2	200	102	100	71	0.0
Chickahominy River	2-CHK057.85	5/2004	1	800	800	800	NA	NA	100.0
Chickahominy River	2-CHK062.57	8/2003 – 9/2011	50	2	2,000	229	100	443	11.8
Chickahominy River	2-CHK067.30	2/2009 - 11/2010	12	25	1,100	206	100	314	25.0
Chickahominy River	2-CHK070.14	3/2007	1	10	10	10	NA	NA	0.0

NA – Not applicable

<sup>1</sup> Based on the instantaneous *E.coli* standard of 235 cfu/100mL in 10% or more of the total samples.

# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	% Violation
Chickahominy River	2CCHK071.66	2/2009 - 11/2010	12	25	2,000	273	100	560	16.7
Chickahominy River	2-CHK076.59	7/2003 - 9/2011	51	10	2,000	208	100	443	11.8
Chickahominy River	2-CHK079.23	1/2007 - 11/2008	12	24	400	119	100	99	8.3
Chickahominy River X-Tributary	2-XYC000.31	4/2006	1	10	10	10	NA	NA	0.0
Collins Run	2-CNR000.66	6/2009	12	100	200	117	100	39	0.0
Collins Run	2-CNR001.54	7/2008 - 6/2009	12	100	300	125	100	62	8.3
Collins Run	2-CNR001.58	7/2008 - 6/2009	12	100	500	175	100	129	25.0
Collins Run	2-CNR002.69	7/2008 - 6/2009	12	100	700	258	100	243	33.3
Collins Run X-Trib	2CXAB000.15	7/2008 - 6/2009	12	100	400	133	100	89	8.3
Dockman Swamp	2-DKM000.04	7/2008 - 6/2009	12	100	200	108	100	29	0.0
Flippen Creek	2-FLP000.92	1/2006 - 12/2006	12	12	4,600	1,047	260	1,586	58.3
Horsepen Branch	2-HOH000.57	1/2006 - 12/2006	12	11	8,000	1,634	425	2,985	66.7

NA – Not applicable

<sup>1</sup> Based on the instantaneous *E.coli* standard of 235cfu/100mL in 10% or more of the total samples.

# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Hungary Creek	2-HUN000.80	1/2006 - 12/2006	12	14	620	253	205	211	33.3
Hungary Creek	2-HUN002.11	1/2006 - 12/2006	12	15	900	298	240	282	50.0
Jones Run	2-JRN000.81	6/2005 - 12/2006	10	25	280	60	25	83	10.0
Jordan Branch	2-JOP001.27	1/2006 - 12/2006	12	41	8,000	1,045	390	2,221	58.3
Lickinghole Creek	2-LKH000.04	1/2009 - 12/2009	12	100	300	142	100	79	16.7
Lickinghole Creek	2-LKH001.00	1/2009 - 12/2009	12	100	800	167	100	202	8.3
Lickinghole Creek	2-LKH001.46	1/2009 - 12/2009	12	100	500	158	100	124	16.7
Lickinghole Creek	2-LKH002.42	1/2009 - 12/2009	12	100	1,200	317	100	351	33.3
Lickinghole Creek	2-LKH003.42	1/2009 - 12/2009	12	100	900	200	100	237	16.7
Lickinghole Creek X-Trib.	2-XOI000.65	1/2009 - 12/2009	12	100	700	183	100	185	16.7
North Run	2-NTR000.23	6/2005 - 5/2011	23	19	2,000	321	150	465	34.8
North Run	2-NTR003.42	7/2003 - 12/2006	23	25	1,300	248	150	352	30.4

NA – Not applicable

<sup>1</sup>Based on the instantaneous *E.coli* standard of 235 cfu/100mL in 10% or more of the total samples.

# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
North Run	2-NTR004.77	1/2006 - 12/2006	12	20	900	348	305	273	66.7
North Run	2-NTR005.53	6/2003 - 3/2004	2	10	160	85	NA	106	0.0
Piney Branch	2-PBR000.12	1/2006 - 12/2006	12	37	7,700	1,363	370	2,514	66.7
Possum Run	2-POS002.62	3/2006	1	50	50	50	NA	NA	0.0
Powhite Creek	2-PWH001.70	3/2005	1	10	10	10	NA	NA	0.0
Powhite Creek	2-PWH002.12	5/2004 - 11/2006	15	25	650	70	25	161	6.7
Rumley Marsh	2-RUM002.46	1/2011 – 9/2011	5	25	150	75	50	59	0.0
Rumley Marsh	2-RUM004.38	6/2005 - 12/2006	10	25	120	66	63	42	0.0
Schiminoe Creek	2-SMN001.42	2/2009 - 11/2010	12	25	1,600	333	125	473	25.0
Stony Run	2-SNF000.04	1/2007 - 12/2009	23	66	900	181	100	188	21.7
Stony Run	2-SNF000.23	1/2009 - 12/2009	12	100	1,100	267	150	293	25.0
Stony Run	2-SNF000.87	1/2009 - 12/2009	12	100	800	175	100	201	8.3

NA – Not applicable

<sup>1</sup> Based on the instantaneous *E.coli* standard of 235 cfu/100mL in 10% or more of the total samples.

# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Stony Run	2-SNF001.27	1/2009 - 12/2009	12	100	1,000	217	100	259	25.0
Stony Run	2-SNF001.58	1/2009 - 11/2009	11	100	1,500	345	100	437	45.5
Stony Run	2-SNF003.70	1/2009 - 12/2009	12	100	1,500	283	100	402	25.0
Stony Run	2-SNF005.59	1/2009 - 12/2009	10	100	2,400	730	300	815	60.0
Stony Run	2-SNF006.44	1/2009 - 12/2009	10	100	1,400	250	100	406	10.0
Stony Run X-Trib	2CXAG000.50	1/2009 - 12/2009	12	100	1,200	267	100	358	25.0
Toe Ink Swamp	2-TIS000.77	8/2003	1	40	40	40	NA	NA	0.0
Trumpet Branch	2-TPT000.31	1/2006 - 12/2006	12	49	20,000	2,607	575	5,617	75.0
Upham Brook	2-UPM000.26	1/2006 - 12/2006	12	18	5,000	681	140	1,412	33.3
Upham Brook	2-UPM001.35	6/2005 – 9/2011	26	25	5,200	630	150	1,171	34.6
Upham Brook	2-UPM002.41	1/2006 - 12/2006	12	27	5,400	998	97	1,736	41.7
Upham Brook	2-UPM003.53	1/2001 - 12/2006	16	47	6,700	977	205	2,008	50.0

NA – Not applicable

<sup>1</sup> Based on the instantaneous *E.coli* standard of 235 cfu/100mL in 10% or more of the total samples.

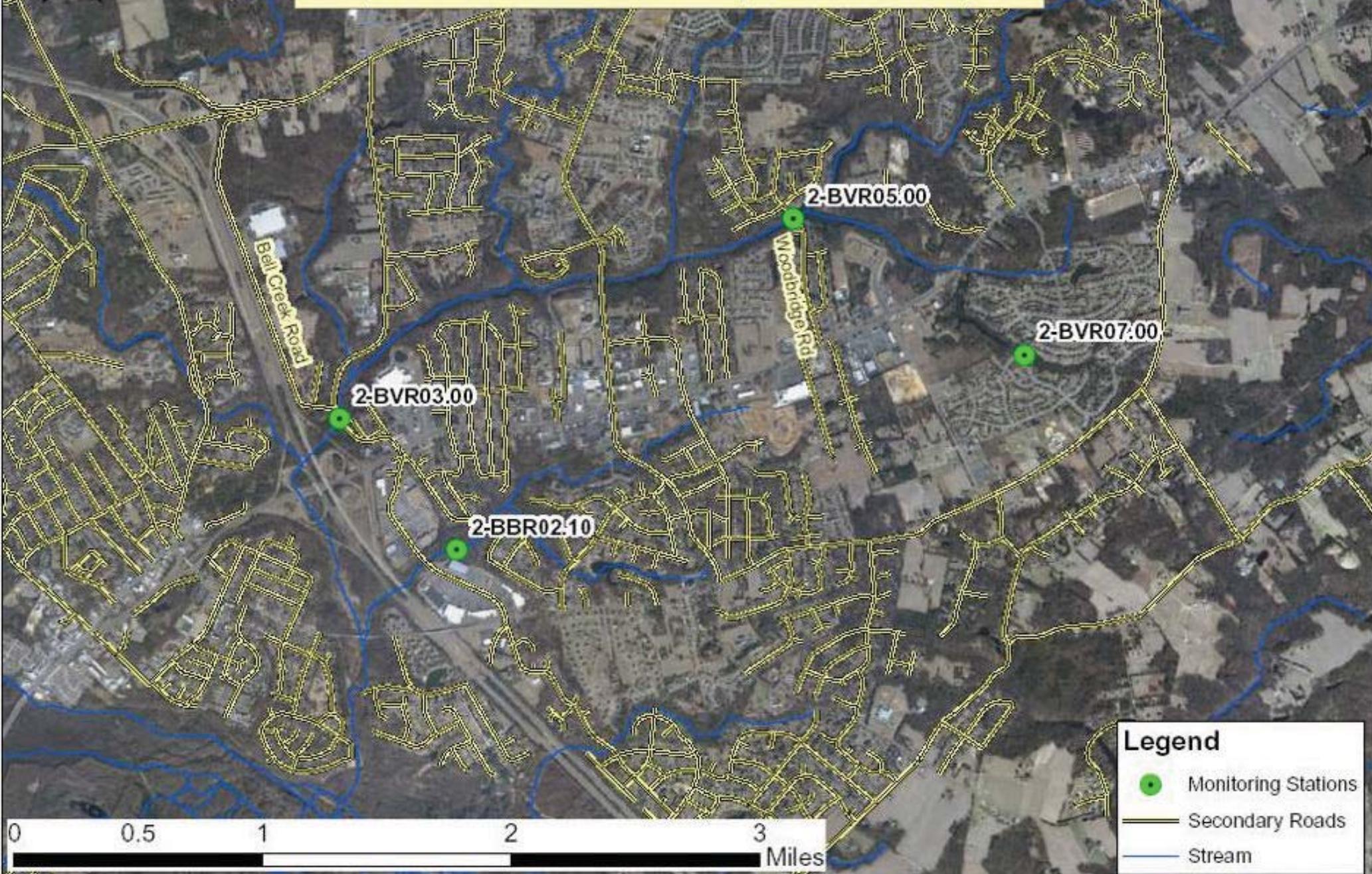
# DEQ Monitoring (*E.coli*)

Stream	Station	Date	Count	Minimum	Maximum	Mean	Median	Standard Deviation	Violation <sup>1</sup> %
Toe Ink Swamp	2-TIS000.77	8/2003	1	40	40	40	NA	NA	0.0
Trumpet Branch	2-TPT000.31	1/2006 - 12/2006	12	49	20,000	2,607	575	5,617	75.0
Upham Brook	2-UPM000.26	1/2006 - 12/2006	12	18	5,000	681	140	1,412	33.3
Upham Brook	2-UPM001.35	6/2005 – 9/2011	26	25	5,200	630	150	1,171	34.6
Upham Brook	2-UPM002.41	1/2006 - 12/2006	12	27	5,400	998	97	1,736	41.7
Upham Brook	2-UPM003.53	1/2001 - 12/2006	16	47	6,700	977	205	2,008	50.0
Upham Brook	2-UPM005.26	1/2006 - 12/2006	12	23	8,000	1,305	130	2,492	41.7
Upham Brook	2-UPM007.03	7/2003 - 12/2006	23	15	8,000	1,068	75	2,419	26.1
Upham Brook	2-UPM008.76	1/2006 - 12/2006	12	15	5,200	1,106	405	1,824	58.3
Upham Brook X-Trib	2CXAR000.57	5/2004 - 12/2006	27	21	5,400	1,064	420	1,558	66.7

NA – Not applicable

<sup>1</sup> Based on the instantaneous *E.coli* standard of 235 cfu/100mL in 10% or more of the total samples.

Citizen Monitoring Locations  
in Mechanicsville Area - Chickahominy Watershed  
(Beaverdam Creek, Brandy Branch Creek)



# Citizen Monitoring (2-BVR03.00)



# NATURAL RESOURCE SOLUTIONS THROUGH Science AND Engineering

# Citizen Monitoring (2-BVR05.00)



# NATURAL RESOURCE SOLUTIONS THROUGH *Science AND Engineering*

# Citizen Monitoring (2-BVR07.00)

Group:	Watershed:	Sample Date	Sample Time	Rain Past 24 Hours (Inches)	Tide Condition	Water Temp C	Incubation Time (hrs)	Incubator Temp C	Sample #	E. coli Vol (ml)	Colonies per Plate	Conservative estimate that 90% of colonies are actual E. coli	Total E. coli Count*
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		!
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		
Christine Beish	Beaverdam Creek			NA	NA				NA	NA	NA		

# Citizen Monitoring (2-BBR02.10)

Group:	Watershed:	Sample Date	Sample Time	Rain Past 24 Hours (Inches)	Tide Condition	Water Temp C	Incubation Time (hrs)	Incubator Temp C	Sample #	E. coli Vol (ml)	Colonies per Plate	Conservative estimate that 90% of colonies are actual E. coli	Total E. coli Count*
Christine Beish	Brandy Branch Creek				NA								
Christine Beish	Brandy Branch Creek				NA								
Christine Beish	Brandy Branch Creek				NA	NA							
Christine Beish	Brandy Branch Creek				NA	NA							
Christine Beish	Brandy Branch Creek				NA	NA							
Christine Beish	Brandy Branch Creek				NA	NA							
Christine Beish	Brandy Branch Creek				NA	NA							
Christine Beish	Brandy Branch Creek				NA	NA							

## Allocation scenarios for reducing current bacteria loads in the Chickahominy River and Tributaries

Scenario	Wildlife Direct	Wildlife Land Based	Livestock Direct	Crop, Pasture & Hay	SSOs	Straight Pipes	Developed	Sub 27 %	Sub 26 %	Sub 25 %	Sub 24 %	Sub 22 %	Sub 19 %	Sub 18 %	Sub 11 %	Sub 10 %	Sub 9 %	Sub 1%
0	0	0	0	0	0	0	0	30.73	19.69	51.54	6.49	32.05	4.19	3.35	6.91	8.38	4.54	0.42
1	0	0	0	0	0	100	0	29.05	14.25	29.54	6.49	29.12	4.19	3.35	3.35	3.84	1.19	0.14
2	0	0	0	0	100	100	0	6.91	1.40	1.75	6.49	9.08	4.19	3.35	0.56	0.49	0.00	0.00
3	0	0	100	0	100	100	0	6.56	1.40	1.47	5.94	8.24	3.98	2.86	0.49	0.21	0.00	0.00
4	0	0	100	0	100	100	50	5.31	1.12	0.98	4.61	7.54	2.44	2.03	0.00	0.00	0.00	0.00
5	0	0	100	50	100	100	50	5.31	1.12	0.98	4.61	7.54	2.44	2.03	0.00	0.00	0.00	0.00
6	0	0	100	99	100	100	99	3.70	0.00	0.00	3.35	6.35	0.21	0.35	0.00	0.00	0.00	0.00
7	50	50	100	99	100	100	99	0.00	0.00	0.00	2.09	0.91	0.00	0.00	0.00	0.00	0.00	0.00
8*	77	77	100	99	100	100	99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00